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BY- BRAINARD, ROBERT W.
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THE BULLETIN, PUBLISHED BIMONTHLY, REPORTS THE CURRENT LITERATURE IN THE AREA OF SCIENCE AND PUBLIC POLICY. THE COVERAGE ENCOMPASSES BOTH "POLICY FOR SCIENCE" AND "SCIENCE FOR POLICY" MATTERS. SCIENCE IS USED TO DENOTE ENGINEERING, TECHNOLOGY, AND SCIENCE. THE BULLETIN IS INTENDED FOR PERSONS ENGAGED IN STUDYING, FORMULATING, OR IMPLEMENTING PUBLIC POLICY RELATING TO SCIENCE AND ITS USE. ITS PURPOSE IS TO AID SUCH INDIVIDUALS BY ALERTING THEM TO NEW ADDITIONS TO THE SCIENCE POLICY LITERATURE. THE INFORMATION PRESENTED CONSISTS PRINCIPALLY OF A BIBLIOGRAPHIC, PARTIALLY-ANNOTATED LISTING OF CURRENT PUBLICATIONS IN THE AREA. PUBLICATIONS OF A HIGHLY TECHNICAL AND NARROWLY SPECIALIZED NATURE ARE EXCLUDED. THE BIBLIOGRAPHIC INFORMATION IS PRESENTED UNDER A NUMBER OF TOPICAL CATEGORIES WHICH ARE (1) GENERAL, (2) SCIENCE, DOMESTIC PROBLEMS, AND NATIONAL GOALS, (3) NEEDS AND ALLOCATION OF RESOURCES FOR SCIENCE, (4) NATIONAL R AND D PROGRAMS, (5) SCIENCE, EDUCATION, AND THE UNIVERSITY, (6) SCIENCE MANAGEMENT AND POLICY MAKING BODIES, (7) SCIENCE, FOREIGN AFFAIRS, AND NATIONAL DEFENSE, AND (8) SCIENCE POLICY IN FOREIGN COUNTRIES. EACH CITED PUBLICATION IS RECORDED UNDER A SINGLE CATEGORY. THE NUMBERING OF PUBLICATIONS UNDER EACH CATEGORY RUNS CONSECUTIVELY THROUGH ALL ISSUES OF THE BULLETIN, SO THAT A GIVEN NUMBER REFERS TO ONLY ONE CITATION. MAJOR MEETINGS AND OTHER EVENTS IN THE SUBJECT AREA ARE ALSO REPORTED. (DS)

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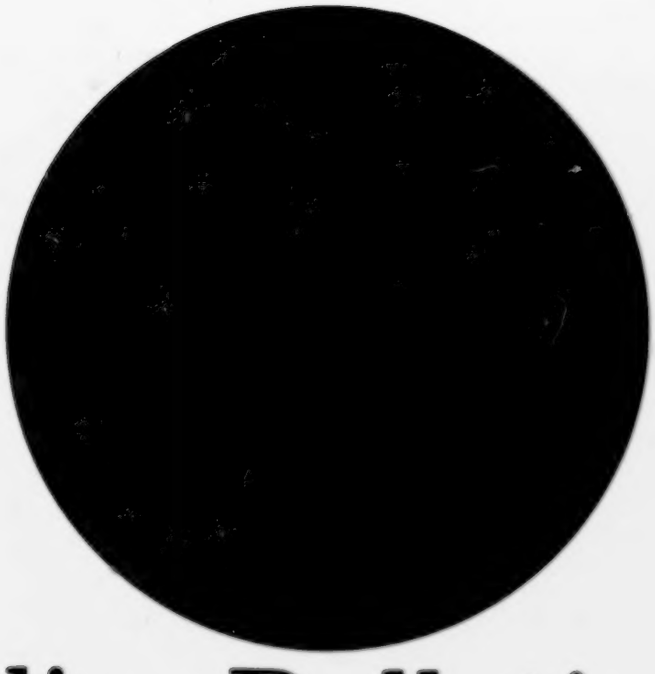

Science Policy Bulletin

Battelle Memorial Institute
Columbus Laboratories

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SCIENCE POLICY BULLETIN

The Bulletin, published bimonthly, reports the current literature in the area of science and public policy. The coverage encompasses both "policy for science" and "science for policy" matters. For brevity, "science" is used to denote engineering, technology, and science.

The Bulletin is intended for individuals engaged in studying, formulating, or implementing public policy relating to science and its use. The purpose of the Bulletin is to aid such individuals by alerting them to new additions to the science policy literature.

The information presented in the Bulletin consists principally of a bibliographic listing of current publications in the area. In addition, major meetings and other events in the subject area are reported.

The bibliography, although covering a broad topical scope, is selective in that publications of a highly technical and narrowly specialized nature are excluded.

The bibliographic information is presented under a number of topical categories. Each cited publication is recorded under a single category; cross indexing is not used. The numbering of publications under each category runs consecutively through all issues of the Bulletin, so that a given number refers to only one citation.

Copies of the listed publications are not available through Battelle but can normally be obtained from the originating agency.

The contribution of information to the Bulletin as well as suggestions and comments on its content, coverage, and format are solicited. All correspondence should be addressed to:

BATTELLE MEMORIAL INSTITUTE
Columbus Laboratories
505 King Avenue
Columbus, Ohio 43201

Attention: Dr. Robert W. Brainard

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BIBLIOGRAPHY

I GENERAL

55. "Technology Transfer and Innovation", National Science Foundation, U.S. Government Printing Office, Washington, D. C., NSF 67-5, 1967, 126 pp.

Proceedings of a conference held in May 1966, under the joint auspices of the National Planning Association and the National Science Foundation. Papers presented include:

(1) A Model of the Innovative Process (in a non-science-based fragmented industry) - Aaron Gellman
(2) A Model of the Innovative Process (in a science-based integrated industry) - J. A. Morton
(3) Technology Transfer - J. Herbert Hollomon
(4) Impact of Law on Technological Innovation - D. V. DeSimone
(5) Business End of Technology Transfer - Robert Charpie
(6) National Science Policy and Technology Transfer - Harvey Brooks
(7) Why Technological Innovations Fail - R. W. O'Neill
(8) Environment for Innovation - Michael Michaelis
(9) Economic Aspects of Technological Development - Gerhard Colm
(10) Role of Science in Innovation - J. E. Goldman
(11) Research in Technology Transfer: Where We Stand and What Needs to be Done - H. E. Riley

56. "An Inventory of Congressional Concern with Research and Development", Eighty-ninth Congress, 2D Session, Part 2, U.S. Senate, Committee on Government Operations, Subcommittee on Government Research, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., October 11, 1967, 151 pp.

This bibliography, compiled by the Science Policy Research Division of the Legislative Reference Service, is the latest addition to the "continuing effort to catalog the myriad congressional publications concerned with science and technology". This bibliography of 469 entries is divided into four sections--public laws and conference committee reports, Senate publications, Joint Committee publications, and House publications.

57. "Studying Science-of-Science", Scientific Research, v. 2, no. 11, November 1967, p. 19.

A "research on research" program has been started by Case-Western Reserve University under a DOD Project Themis grant. The program, which is being directed by Case's Operation Research Department, will include a structure-function analysis of the role and interrelationships of Congress, the Executive, DOD, universities, and industry in R&D. This will be followed by an attempt to deal with such policy issues as: the roles of universities in R&D, the conflict between basic and applied research, how much the U.S. should spend on R&D, and the criteria for distributing R&D funds.

58. Seaborg, C. T., "Toward a Science of 'Techumology'", Air Force and Space Digest, v. 50, no. 12, December 1967, pp. 82-84, and 87.

Science and technology must join forces with those in the educational, social, and political fields to create a body of technical and humanistic wisdom that is integrated into a single discipline of "techumology". Modern science and technology is "forcing man to face his 'moment of truth . . .to achieve a vital synthesis of all that is material with all that is moral". The author rejects the concept of a "moratorium on all technological advances until we catch up sociologically" and endorses Weinberg's concept of the "technological fix": we "must use all the technology at our command, and then some, to correct past errors, to reverse harmful trends, to anticipate and fulfill future needs" and to coordinate all facets "so as to limit the number and scope of any future blunders". Numerous examples of problem areas ripe for such joint efforts are presented.

59. de Solla Price, D. J., "Research on Research", reprinted from Journeys in Science: Small Steps--Great Strides, D. L. Arm (Ed.), Report of the Twelfth Air Force Office of Scientific Research Science Seminar, The University of New Mexico, 1967, pp. 1-21.

The author describes his "research on research" and discusses some of the more significant findings and implications. "The procedure in this work has been to use headcounts of scientific manpower, published papers and journals, patents and money, and then to suppose that these quantities measure in some mysterious way the 'size' of science". These numbers are then correlated with various indices of peoples and nations to arrive at insights into the workings of science and technology. A few of the many topics studied in this way are: authorship and citation patterns as they reflect the mechanisms by which science accumulates; the differences and interactions between science and technology;

economics of science; the minimum cost for a nation to participate in modern science and the amount that can be spent on technology.

60. Seitz, F., "Summary Comments on Government-Science Relationships", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 85-97.

The evolution of the present pattern of science-government policies in the U.S. is summarized. Some of the science-policy problems common to advanced countries are cited and national differences in the organization and management of science are discussed. The common problems cited include: Research-Development-Production (improved means of transferring research to development and then into production are needed); Big Science (how much money to "big" versus "little" science and the role of international programs); Research on Research (more planning is needed for research at the higher levels of government). In his concluding remarks, the author asks: "Are the benefits to be expected from research and development somewhere near saturation?"

61. King, A., "Science and Education in O.E.C.D.", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 101-117.

This paper describes the development and activities of the Organization for Economic Cooperation and Development (OECD) in the areas of science and education. OECD's program in education is discussed, its efforts to promote international cooperation in research are cited, and its extensive and growing activities in the area of science policy are detailed. "At present the greatest interest is undoubtably focussed on the disparity of research and development resources between countries and its significance for future economic, social, and even political development".

62. Beller, W. S., "Decision-Making in Washington", Space/Aeronautics, v. 48, no. 7, December 1967, pp. 83-98.

"Governmental decisions on science and technology have been hobbled by the lack of a broad policy". There "appears to be no national policy for science and technology, no urgency to find one, no understanding that one is necessary, nor even agreement that one is possible". Although the Bureau of the Budget "attempts to establish priorities within each federal agency", it has no policy guidelines for weighing the "programs of one

agency against those of another". Congress is hampered by a committee structure that "tends to keep science and science policy fragmented". Against this background, the author comprehensively describes and evaluates the Executive policy-making apparatus.

63. Bass, L. W., and Old, B. S. (Eds.), Formulation of Research Policies, Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, 210 pp.

Proceedings of the 1966 Gordon Research Conference on the Formulation of Research Policies. The publication includes a total of 18 papers: seven deal with the science policies of specific countries, three with international science policies, four with policies of groups and corporations, and four with general policy matters. (The papers are cited individually in this issue of the Bulletin).

64. Sir Harry Melville, "Policies for Scientific Research", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 77-84.

Several questions regarding policies for basic research are raised and some possible solutions are suggested. These include: how should public-funded basic research be justified, and how is the exponential growth of needed funds to be met? Can a country afford to engage in all fields of science, and if not, is the participation in international cooperative pools a solution? And, what is the necessary level of contact between the scientist and politician who controls the money?

65. Research in the Service of National Purpose, F. J. Weyl (Ed.), Department of the Navy, Office of Naval Research, U.S. Government Printing Office, Washington, D. C., 1966, 133 pp.

Proceedings of the Office of Naval Research Vicennial Convocation held in May 1966. The broad theme of the convocation was "Science and Public Policy" with special emphasis on the roles and achievements of the Office of Naval Research (ONR). Three historical appraisals of ONR and four addresses on science and public policy are presented:

Pioneering in Federal Support of Basic Research - A. T. Waterman
Catalyzing Advances in Military Technology - J. S. Foster, Jr.
Innovating in the Support of Naval Operations - H. Rivero

Basic Science and Agency Missions - H. Brooks
Promises and Constraints on Science - F. Seitz
The Open World of Science - S. Zuckerman
Science and National Security - W. O. Baker
(The last four papers are cited individually in this issue of the Bulletin).

66. Sir Solly Zuckerman, "The Open World of Science--The Impact of Security on the Balance and Quality of Scientific Effort", paper in Research in the Service of National Purpose, F. J. Weyl (Ed.), Department of the Navy, Office of Naval Research, U.S. Government Printing Office, Washington, D. C., 1966, pp. 66-91.

The "conditions of scientific progress" is the broad theme of this discussion. The discussed topics include: the characteristics and needs of the individual scientists; the significant changes in science during the last 25 years and their policy implications; the setting of priorities in basic research, applied research and development, and the role of the scientist; the significance of communication and secrecy in science, with recommendations for policy on government-funded basic research; the "differences between the social and the exact sciences"; and the role of "value-judgments" in the allocation of resources to science.

67. Seitz, F., "Promises and Constraints on Science", paper in Research in the Service of National Purpose, F. J. Weyl (Ed.), Department of the Navy, Office of Naval Research, U.S. Government Printing Office, Washington, D. C., 1966, pp. 48-65.

The general "state of health" of U.S. science is discussed and its future prospects are assessed. Strong points of the U.S.'s posture in science and science-based technology are cited; primary constraints on future developments are said to originate in our tradition and secondary ones in "competition between 'big science' and 'independent science'" and in issues involved in the geographical distribution of R&D funds; the prime "hazards to the advance of our science-based civilization" are identified as the population explosion and global war.

68. Prehoda, R. W., Designing the Future, The Role of Technological Forecasting, Chilton Book Co., New York, 1967, 310 pp.

"This book presents a rationale concerning our potential ability to accurately foresee the future capabilities and results of applied science". The first part of the book relates "economic parameters to science, education, defense, and other vital areas"; the second part outlines "physical science disciplines where current

technological forecasts indicate that a considerable increase in R&D funding can be invested profitably"; and the third describes "biomedical research possibilities that may have a dramatic effect on" our lives.

69. Hornig, D. F., "Charles Lathrop Parsons Award Address", Chemical & Engineering News, v. 46, no. 1, January 1, 1968, pp. 50-53.

"The central problem of sound science policy is to combine sound management and planning with a pluralistic process in which all relevant factors are juxtaposed". The author defines "science policy", discusses the pragmatic approach taken to science policy in the U.S., contrasts it with the planned, rationalized approach being tried in Europe, and notes that the tightening R&D budget requires the U.S. to plan and coordinate better in the future. A call is made for the scientific community to "explain its goals, its methods, and its values in ways" meaningful to the nonscientist; for a better understanding by the public of the "strengths, limitations, and possibilities" of science; and for greater participation by scientists in government.

70. Boffey, P. M., "American Science Policy: OECD Publishes a Massive Critique", Science, v. 159, no. 3812, January 12, 1968, pp. 176-178.

"A report that is believed to be the most comprehensive look at American science policy ever taken by outside observers has been issued by the Organization for Economic Co-operation and Development (OECD)". "Although balanced in appraisal and basically laudatory in tone, the 622-page volume. . .is filled with impressions of weakness in the American system." The author reviews and comments on the individual reports of the four-man OECD examining team. (The final version of the report, which will contain an account of the "confrontation meeting" with U.S. science officials, is to be available in the U.S. after 15 March 1968, from the OECD Publication Center, 1750 Pennsylvania Ave., N.W., Washington, D. C.)

71. "Does the United States Have a Science Policy?", Nature, v. 217, January 20, 1968, pp. 225-231.

The article reviews the appraisal of the U.S.'s science policy by the Organization for Economic Co-operation and Development (OECD). "The underlying tone of the document which the OECD has prepared is one of wonder at the scale on which science and technology are supported in the United States". OECD's report "will probably be more valuable to those outside the United States" than

to "those in the United States who may have been looking to the report for solutions to some of the problems which are now becoming prominent".

72. Greenberg, D. S., The Politics of Pure Science, The New American Library, New York, 1967, 303 pp.

This book, by the News Editor of Science, is a critical study of the political aspects of U.S. basic science. The book is divided into three parts: the first describes the scientific community and the values of its members; the second traces the growth of science-government relations from pre-WWII to the present; and the third looks at the "government" side of the picture, reports a series of episodes (Mohole, High Energy Politics) that "illuminate the intricacies of the politics of pure science", and discusses the future problems the scientific community faces in obtaining public support of research.

73. "Anglo-Saxon Problems in Science and Technology", Nature, v. 217, no. 5123, January 6, 1968, pp. 1-2.

What "policies towards science and technology should the American and British Governments pursue at a time when both of them are being forced to reduce public expenditure quite drastically?" For the U.S., it is recommended that a greater proportion of the government's support of basic research be undertaken by independent agencies such as the National Science Foundation rather than by mission-oriented agencies. For Britain, the real question is how basic research should be split and balanced among the government establishments, universities, and industry.

II SCIENCE, DOMESTIC PROBLEMS, AND NATIONAL GOALS

45. "Regional R&D Funding Study", Industrial Research, v. 10, no. 2, February 5, 1968, p. 14.

> The new Committee on Science, Engineering and Regional Development (under the National Academy of Sciences and the National Academy of Engineering) will study the impact of R&D on regional economics. The study, funded by the Commerce Department for $95,000 and headed by Daniel Alpert (dean of the Graduate College, University of Illinois), will focus on the social, political, and economic factors in development. The committee will also examine such policy questions as: "How much geographical distribution of funds is necessary or desirable in pursuit of a strong national economy"; what should the criteria be for selecting site locations for new R&D facilities.

46. "Evaluating Regional Act", Industrial Research, v. 10, no. 2, February 5, 1968, p. 12.

> The State Technical Services Act comes up for renewal this year with prospects of future funding uncertain. An evaluation committee, set up under the Act, has proposed: a three-year extension of the program at a level of $30 million per year, an increase in the portion of funds allowed for special merit programs, an increase in the federal contribution to programs from 50 percent to 80 percent, and expansion of the authority to issue nonmatched planning grants. "A significant funding increase may have trouble clearing the Department of Commerce": the actual appropriations over the last three years were $3.5, $5.5, and $6.5 million, compared to the initiating authorizations of $10, $20, and $30 million.

47. "All-Purpose AEC?", Industrial Research, v. 10, no. 2, February 5, 1968, pp. 13-14.

> The Atomic Energy Commission omnibus bill, passed by Congress in the last session, offers AEC the opportunity to "mobilize its resources and come up with an outline of how to approach the overall environmental pollution problem of the megalopolis". This bill, which was not "aired in open hearings", asks for an agency "that some charge is a contributor to pollution, to act as an advocate to anti-pollution".

48. Lessing, L., "Systems Engineering Invades the City", Fortune, v. 77, no. 1, January 1968, pp. 154-157, 217, 218, and 220-221.

The use of systems engineering in dealing with urban problems is illustrated and discussed, and the several obstacles to be overcome are noted. In the past, patchwork solutions to urban problems tended to cancel one another out; the systems approach, in contrast, would ideally try to deal with the city as a whole. However, current systems studies are confined to certain problem areas such as crime, transportation, and housing. But within these broad areas, some notable results have been achieved. The several obstacles to applying systems engineering include the politician's lack of comprehension of these new methods, the shifts and vagaries of administration, antipathy toward long-range planning, and the fragmentation of federal, state, and local governments. It is concluded that some profit mechanism is needed to bring the systems-oriented industry into urban problems on a significant basis.

49. "The Automobile and Air Pollution: A Program for Progress", Report of the Panel on Electrically Powered Vehicles, U.S. Department of Commerce, U.S. Government Printing Office, Washington, D. C., October 1967, 51 pp.

This report discusses the relation of automotive emissions to air pollution, what technology has to offer for ameliorating the problem, and the role of industry and government. Conclusions include: not enough is known about the effects of specific pollutants on public health; "virtually non-polluting transportation systems" must be quickly developed; although some reduction in emissions "will be commercially feasible during the next decade", "no significant reduction in total air pollution will be achieved" from "unconventional low-polluting vehicles" in this period; incentives for industry to apply pollution-control technology are inadequate; the federal government has the responsibility to "determine the effects of pollution and to establish realistic air-quality goals and nationwide standards"; local governments have not recognized the importance of the pollution problem; and the authority and responsibility for pollution research and control has "not been established at an organizational level within the federal government consistent with the magnitude and importance of this problem". Recommendations emphasize the establishment of standards, more R&D, and the elevation of responsibility for anti-pollution activities to higher levels in the government.

50. "White House Wants Federal Energy Policy", Electrical World, v. 169, no. 4, January 22, 1968, pp. 69-70.

The Office of Science and Technology (OST) has appointed David Freeman as director of its new Energy Policy Staff. This group of OST has the responsibility for establishing and coordinating energy policy on a national basis. In the past, "energy policy has evolved over single issues. No one has looked to see if they fall into a unified coordinated program". Freeman indicates that areas and questions of particular concern include: reconciliation of the need for clear air and water with low-cost electricity; ownership patterns of electric utilities that are in the public interest; taxation and regulatory procedures; and the government's role in R&D.

51. "Technology Transfer", Hearings before the Subcommittee on Science and Technology, Select Committee on Small Business, (September 20, 26, 27, 28 and October 12, 1967), U.S. Senate, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., 1967, 235 pp.

These hearings, held in September and October 1967, are a continuation and expansion of the earlier report "Policy Planning for Technology Transfer". Their objective is to provide a basis for policies that will "assure the maximum utilization of technology from federally sponsored R&D programs". Statements and testimony were solicited from "trade associations and business groups which are potential users of government controlled information", from organizations that are involved in the transfer process itself, and from the federal agencies under which the new technology is developed.

52. "Urban Research Committees Named", News Report (Publication of the National Academy of Sciences - National Research Council - National Academy of Engineering), v. 17, no. 10, December 1967, p. 8.

"Two parallel committees have now been organized within the National Research Council to study the technical and human aspects of applying research and development to urban problems. They will be the chief instruments by which the NAS and the NAE will provide advice to the Department of Housing and Urban Development on long-range strategies for using research and technology to improve the quality of urban life."

53. "Aircraft Noise: Unrelenting, Unremitting, Intolerable", Environmental Science and Technology, v. 1, no. 12, December 1967, pp. 976-981, and 983.

Although there are some 30 pending House bills seeking to solve the aircraft-noise problem, there are no

"solutions imminent for instantaneous control and abatement of aircraft noise". The various legislative and technical efforts to deal with the growing noise problem and obstacles to an effective solution are discussed.

54. "Noise Pollution", Science, v. 158, no. 3809, December 29, 1967, p. 1655.

"A special committee has been appointed by Secretary of the Interior Udall to study the impact of noise in the environment. The effect of widespread sonic booms is expected to be one topic that will come under study. The group, which met for the first time on 20 December, is expected to issue a report on its findings in mid-1968."

55. Roos, N. J., and Priest, J., "Civilian Diversification in the Defense/Space Industry", Research Management, v. X, no. 6, November 1967, pp. 409-424.

"Can general competence developed for defense and space projects be productively applied to the civilian market place?" This survey of the defense/space industry was undertaken in 1965 "to determine to what extent the industry was actually planning diversification moves" into the civilian sector of the economy. The results revealed a "very high interest" and a "concerted effort to diversify". The diversification areas cited most frequently were: oceanography, urban transportation, industrial-process automation, medical diagnostic equipment, educational aids, air traffic-control, and hospital automation. For each of the 14 diversification areas cited, information is presented as to the presumed customer, the planned near-term effort, the earliest operational date, and the expected funding and revenue levels.

56. Science, Engineering, and the City, Publication No. 1498 of the National Academy of Sciences, Washington, D. C., 1967, 140 pp.

Proceedings of a symposium on Science, Engineering, and the City, held in April 1967 under joint sponsorship of the National Academy of Sciences and the National Academy of Engineering. Broadly, the symposium was "designed to assess the current interaction of technology with urban problems and to outline a set of tactics to guide action during the next few years". The four sessions of the meeting dealt with "Social Requirements for Urban Design", "Urban Transportation Problems", "Urban Construction", and "Urban Experimentation Program".

57. Nelson, R. R., Peck, J. J., and E. D. Kalachek, "Promoting Technology and Economic Growth", Brookings Research Report 61, The Brookings Institution, Washington, D. C., 1967, 9 pp.

This report is adapted from Technology, Economic Growth, and Public Policy, by the same authors. It summarizes the earlier book and presents some "specific proposals for more effective use of American R&D resources". The "proposals are designed to deal with the major failures in the existing structure of private incentives and capabilities".

58. "Industry Sonic Boom Research is Scarce, NAS Survey Finds", Aerospace Technology, v. 21, no. 16, January 29, 1968, p. 23.

"Dramatic reductions in sonic boom intensity produced by supersonic aircraft are not 'readily apparent' in the near future. This is the major conclusion reached by a National Academy of Sciences subcommittee probing the supersonic transport sonic boom situation". NAS "recognized that work is needed urgently on sonic boom psychoacoustical and structural response problems. . .but confined its probe to the generation aspects".

59. Commoner, B., "Duty of Science in the Ecological Crisis", Scientist & Citizen, v. 9, no. 8, October 1967, pp. 173-182.

"I believe that we are approaching, in our time on this planet, a crises which may destroy its suitability as a place for human society". The nature of ecosystems is briefly discussed and some examples of human intrusions on the environment are cited; the causes and consequences of air, water, and soil pollution are described; and the social responsibility of scientists and engineers for providing information and educating the public is discussed.

60. Sweeney, S. B., and Charlesworth, J. C. (Eds.), Governing Society: New Scientific Approaches, Monograph 7, the American Academy of Political and Social Science, Philadelphia, May 1967, 254 pp.

Parts II and IV of this monograph treat the "Relevance of Science and Technology to Urban Problems" and "Progress in Applying Science and Technology in Urban Government", respectively.

61. "Automotive Air Pollution", Sixth Report of the Secretary of Health, Education, and Welfare, to the Congress of the United States, in compliance with Public Law 88-206 as amended by Public Law 89-272, U.S. Senate, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., June 1967, 13 pp.

This report describes the progress being made in controlling automotive air pollution, the current emission-control research (federal and industrial programs), atmospheric measurement, research on health-effects criteria, air quality standards, and emission standards.

III NEEDS AND ALLOCATION OF RESOURCES FOR SCIENCE

31. "Cutbacks Pinch Federal Plans", Industrial Research, v. 10, no. 2, February 5, 1968, p. 11.

This brief article cites some of the effects of the 1968 cuts in R&D obligations and discusses prospects for 1969. Since R&D is only a portion of most agencies' budgets, the full impact of the cuts on R&D can't be assessed at this time. However, agencies whose prime mission is R&D offer some indication of what the cuts mean: AEC must obligate $250 million less than planned, but expenditures are estimated to drop by only $80 million; obligations and expenditures by NSF are expected to drop by $52 million and $36 million, respectively; NASA is exempted from the cut because of previous reductions. The total cuts in R&D obligations could reach as much as $1.5 billion, with a spending reduction of $1 billion. Prospects for 1969 are not encouraging; Congress is expected to make further cuts.

32. "Federal Funds for Research, Development, and Other Scientific Activities--Fiscal Years 1966, 1967, and 1968", National Science Foundation, v. XVI, U.S. Government Printing Office, Washington, D. C., NSF 67-19, August 1967, 248 pp.

This report describes the federal government's funding for basic research, applied research, development, R&D plant, scientific information work, and general purpose data collection. The presented data include the support by each federal agency to each category of scientific activity and the distribution by each agency of funds among the types of performers and among the fields of science.

33. "Equitable Distribution of R&D Funds by Government Agencies", Hearings before the Subcommittee on Government Research, of the Committee on Government Operations, U.S. Senate, Ninetieth Congress, First Session, S. Res. 110, Part 2--537 pp., and Part 3--761 pp., U.S. Government Printing Office, Washington, D. C., 1967.

Statements and testimonies by 40-50 parties (e.g., Donald F. Hornig, J. Herbert Hollomon, Leland J. Haworth, Daniel Alpert, Harvey Brooks, Frederick Seitz, Philip Handler) on the geographic distribution of Federal R&D and the impact of science and technology on regional economic development. The questions addressed included: (1) How does science and technology affect regional economic development? (2) What factors determine

regional needs in science? (3) What factors determine regional potential in science? (4) What organizational structures are needed to promote science and technological development in individual regions? (5) Are science and technology essential for economic development? (6) What type of assistance should the Federal Government give to build a regionally relevant science capability? (7) How might the Federal Government stimulate local development of science?

34. "Expenditures Continue Upward--R&D Associated with Social Problems on Increase", Battelle Technical Review, v. 17, no. 1, January 1968, pp. 2-3.

Total 1968 R&D expenditures in the U.S. are expected to reach $26.5 billion; this is an increase of $700 million, or 3.3 percent, over estimated 1967 R&D spending. In respect to sources of funds, Battelle forecasts that Federal government spending will total $17.2 billion; industry, about $8.3 billion; colleges and universities, $865 million; and other nonprofit institutions, $265 million. Federal R&D expenditures in 1968 are expected to rise by 2.2 percent over 1967, while industrial R&D is expected to increase by 4.8 percent, and the universities' by 8.8 percent. Significantly, it is estimated that for calendar year 1968 the increase in Federal funding in the social sciences will be greater than the increase in the physical sciences.

35. "NSF Special Commission on the Social Sciences Appointed", National Science Foundation News Release, NSF 68-107, February 1, 1968, 4 pp.

NSF has established a "Special Committee on the Social Sciences" to examine ways to improve the generation and application of social science knowledge. The eleven-man committee is specifically charged with producing (1) a statement and analysis of the mechanisms and institutions needed for making effective use of the social sciences in "understanding and dealing with significant problems in our society", (2) an analysis, with recommendations, of the forms of collaboration that may be necessary among the social and natural sciences and engineering, and (3) a statement of the federally sponsored measures and programs that "are required so that the social sciences may be more effective both in generating new knowledge and in its utilization".

36. "Federal Research, Development, and Related Programs", Special Analysis J of Special Analyses, Budget of the United States, Fiscal Year 1969, U.S. Government Printing Office, Washington, D. C., 1969, pp. 135-154.

This analysis identifies Federal funds for research, development, and facilities related to both activities, as presented in the President's budgetary recommendations. Federal obligations for R&D will increase from $16.9 billion in 1968 to $17.8 billion in 1969, while the total expenditures will increase from $16.5 billion to $17.3 billion. Obligations for research (applied and basic) will increase from $5.5 billion in 1968 to $6 billion in 1969; expenditures will increase from $5.2 to $5.7 billion. Comparable figures for development are $10.8 billion in 1968 to $11 billion in 1969, with expenditure increasing from $10.6 billion to $10.9 billion. Separate analyses are presented for academic research, atmospheric sciences, environmental quality research, marine science and technology, medical research, space, water, and for the major Federal agencies.

37. "R&D Activities in State Government Agencies--Fiscal Years 1964 and 1965", National Science Foundation, U.S. Government Printing Office, Washington, D. C., NSF-67-16, September 1967, 68 pp.

This report is the first attempt to collect data on the R&D activities of all the State government agencies. Expenditures for R&D are given by character of work, performer, source of funds, field of science, and functional area. Major findings include: (1) state agencies spent $72 million in 1964 and $88 million in 1965 for R&D; (2) five states (New York, California, New Jersey, Illinois, and Pennsylvania) accounted for about one-half of the total R&D; (3) state R&D programs concentrate on the life sciences rather than the physical sciences; (4) health and hospitals, natural resources, and highways are the leading functional areas for R&D; (5) more than three-fourths of the expenditures are for intramural performance.

38. "Scientific and Technical Personnel in the Federal Government, 1964", National Science Foundation, U.S. Government Printing Office, Washington, D. C., NSF 67-21, August 1967, 30 pp.

This report presents information on the occupational characteristics of the nearly 190,000 professional and 97,000 non-professional scientific and technical workers employed by the Federal Government in December 1964. Included are analyses of occupational trends covering the decade 1954 to 1964 as well as information on growth rates.

39. "Scientific Activities of Nonprofit Institutions", 1964 Expenditures and January 1965 Manpower, National Science Foundation, U.S. Government Printing Office, Washington, D. C., NSF 67-17, September 1967, 111 pp.

This questionnaire survey is "the most comprehensive single analysis of science expenditures and manpower in the nonprofit sector thus far undertaken by the Foundation". The survey, which is to be repeated biennially, encompasses research institutes, Federal Contract Research Centers managed by nonprofit institutions, science exhibitors, professional and technical societies, academies of science, and private philanthropic foundations. Major findings include: (1) the number of scientists and engineers has grown from 5,300 in 1954 to 17,400 in 1965; (2) R&D expenditures rose from $110 million in 1953 to $610 million in 1964, which represents an increase from 2 percent in 1953 to 3 percent in 1964 in the nonprofits' share of the nation's total R&D outlay; (3) the average expenditure per scientist and engineer was $35,200 in 1964, compared with $20,300 in 1953.

40. "Basic Research, Applied Research, and Development in Industry, 1965", National Science Foundation, NSF 67-12, U.S. Government Printing Office, Washington, D. C., June 1967, 128 pp.

This report surveys funds and personnel engaged in R&D in U.S. industry. R&D expenditures for 1965 totaled $14.2 billion, with five industry groups accounting for 85 percent of the total. The federal government sponsored 55 percent of the R&D and industry the remainder; however, industry-financed research continues to rise more rapidly than does the government portion. Data are presented on the distribution of R&D funds by size of company, by geographic region, and by major-cost categories (scientists and engineers, supporting personnel, materials and supplies, and other), as well as on the number and distribution of scientists and engineers in R&D, and the expenditures devoted to basic research and to applied research and development.

41. "Research in the Service of Man", Hearings before the Subcommittee on Government Research, Committee on Government Operations, (February 28, March 1, 2, 3, and 16, 1967), U.S. Senate, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., 1967, 273 pp.

These hearings, held in early 1967, are concerned with evaluating the role and adequacy of federal institutions in biomedical development. The specific questions posed by the Subcommittee to over 20 experts included: Is

more attention by federal agencies needed in biomedical development? Are existing procedures satisfactory for setting research priorities and for long-range planning? Are present mechanisms for implementing plans and priorities adequate? Are means of communication between the scientific community and federal agencies satisfactory? Are additional federal institutions needed to further develop and apply biomedical knowledge?

42. "Communication Systems and Resources in the Behavioral Sciences", Publication No. 1575 of the National Academy of Sciences, Washington, D. C., 1967, 67 pp.

This report, prepared by a committee of the National Research Council, makes recommendations for improving the availability of information in the behavioral and social sciences. The committee calls for a decentralized national network of data banks containing statistical information on domestic and foreign populations; a Federal Data Service Center for the government's statistical data; and a time-shared communication and information system that would link researchers throughout the country. Special attention is given to the need for safeguards against disclosure or abuse of the information: the recommended data centers should be established "only on condition that stringent safeguards of individual privacy can be assured".

43. Parmeter, T., "The Case For--and Against--A National Social Science Foundation", Trans-Action, v. 5, no. 3, January/February 1968, pp. 54-56.

This paper reviews the provisions of the Congressional bills to create a National Social Science Foundation, surveys the support that the social sciences are currently receiving, and presents a large sampling from the Congressional hearings on the bill that is edited and condensed so as to focus on the key issues and concerns.

44. "Scientific Programs in the Department of the Interior", Hearing before the Committee on Interior and Insular Affairs, U.S. Senate, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., 1967, 147 pp.

The recent scientific and technological developments and programs within the Department of the Interior are reviewed. The first quarter of the document contains statements by the Secretary of Interior, the Science Adviser of the Department, and other officials of the Department; the remaining sections describe major R&D activities and selected programs.

45. Danilov, V. J., "R&D Expenditures", Industrial Research, v. 10, no. 1, January 1968, pp. 60-62.

This article surveys and discusses the slowdown in R&D expenditures in government and industry. Most of the increase in R&D spending in 1968 is expected to come from industry, but even here R&D is "being inhibited by the lack of government support, a 'soft economy', and an unclear view of the future". The "research industry is passing through a transitional period that could bring about a much lower and earlier plateau in R&D support than anyone anticipated".

46. "National Foundation for Social Sciences", Hearings before the Subcommittee on Government Research, of the Committee on Government Operations, U.S. Senate, Ninetieth Congress, First Session, S. Res. 836, Part 2--497 pp., and Part 3--809 pp., U.S. Government Printing Office, Washington, D. C., 1967.

These documents contain the Senate hearings of June and July 1967 on Sen. Fred Harris' bill to create a National Social Science Foundation.

47. "Manpower and Training Needs in Water Pollution Control", Report of the Department of the Interior Federal Water Pollution Control Administration, to the Congress of the United States, in compliance with Public Law 89-753, U.S. Senate, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., 1967, 50 pp.

The report discusses the present manpower resources and future requirements, educational and training needs, training programs and opportunities, and personnel utilization and recruitment.

48. Cohen, A. V., and Ivins, L. N., "The Sophistication Factor in Science Expenditure", Science Policy Study No. 1, Her Majesty's Stationery Office, London, December 6, 1967.

It is often assumed that because of the growing complexity of science, research costs increase by about five percent per annum for each scientist. This study of 16 British institutes found the "sophistication factor" to be between two to five percent. Of the costs for salaries, buildings, and equipment, the latter showed the fastest growth rate, although it accounted for only 18 percent of the total expenditures. In some cases the cost of equipment per scientist rose by 20 percent per year and in many by as much as 10 percent.

49. "Special Report: The 1969 Federal R&D Budget", Washington Science Trends, v. XIX, No. 16-17, January 29 - February 5, 1968, pp. 94-103.

"Federal spending for research and development will reach a new record peak for Fiscal 1969 despite almost overwhelming pressures from war spending and demands for social reforms". This Special Digest surveys the government's planned expenditures and areas of emphasis in Marine Science and Technology, Biomedical Research and Health Services, Atomic Energy Commission, Department of Commerce, Agricultural Research, Department of Transportation, Academic Research, U.S. Office of Education, Atmospheric Sciences, Department of Interior, Defense R&D, and NASA and other Space Programs.

IV NATIONAL R&D PROGRAMS

37. "Omnitron Supporters Fight for Funding in New Federal Budget", Scientific Research, v. 3, no. 1, January 8, 1968, p. 11.

Efforts are being made to get the 1,500-MeV Omnitron accelerator into the fiscal '69 budget after it was cut from the '68 budget by the Congressional Joint Committee on Atomic Energy. A technical panel appointed by AEC to look into the scientific need and feasibility of the Omnitron has reported with high favor on both aspects.

38. Ramo, S., "Space and National Priorities", Air Force and Space Digest, v. 50, no. 12, December 1967, pp. 78-81.

The U.S. is moving into a new period "in which truly objective, comparative analysis of the worth of the space effort has a chance of becoming the dominant factor in determining what the space program will be". Numerous domestic and international problems compete for attention and change the context for questions regarding the worth of our space efforts. But at the same time, many new options are available for the space program. "We have it within our power of choice to so exploit what we have learned about space technology as to produce values for our society in the 1970's substantially greater than the entire space program will have cost us in the 1960's". Several examples of new space-generated technology that will be available by the end of 1970 are cited in the fields of communication, control, education, and natural resources.

39. Dickson, P. A., "Hard Selling Technology", Electronics, v. 41, no. 2, January 22, 1968, pp. 111-115.

NASA has recently launched three new activities under its Technology Utilization program to enhance the transfer of technology: (1) nine Regional Experimental Dissemination Centers that "deliver tailored packages of technical information to companies"; (2) a center to sell NASA computer programs; (3) three biomedical teams that work with R&D groups at hospitals and universities to apply aerospace technology to medical problems. These new efforts, which focus on marketing problems (e.g., industry disinterest), take priority over the older features of the program. The program "is being pushed harder these days" even though NASA's "limited budget cramps its style in this area"; however, "some cynics maintain that NASA is using the program primarily

to sell the public and Congress on the value and need of its space effort".

40. "'Gulf Science Year' Project Proposed", Scientific Research, v. 2, no. 12, December 1967, pp. 21-22.

A consortium has been formed for a "Gulf Science Year" to explore the biology, geology, and oceanology of the Gulf of Mexico. The consortium, which consists of 16 universities and research institutes, is aiming for a $10 million program to be launched in 1970. The Gulf University Research Corporation (GURC) was formed "to drum up federal government funds and other support" for the program. "At present GURC is largely a paper organization, with no specific proposals"; the former chief of NASA's earth-resources survey program, Peter C. Badgley, has been appointed "to draw up initial plans for direction and development of GURC programs".

41. Dillion, E. L., "Marine Science Affairs--A Year in Review", Under Sea Technology, v. 9, no. 1, January 1968, pp. 57-58.

The Program Officer of the National Council on Marine Resources and Engineer Development reviews the 1967 activities of the Council. Two "qualitative developments" have occurred during the year: "considerations of ocean and coastal zone development have been raised to the highest level in Government" and the Council now serves "as a policy and program innovator to mobilize the capabilities of the operating agencies around fresh new programs that cross agency lines".

42. Betts, S. W., "Weather Modification in the USA", New Scientist, v. 37, no. 578, January 4, 1968, pp. 20-23.

The author, who is Executive Secretary of the U.S. Interdepartmental Committee for Atmospheric Sciences, describes the current and planned government-supported research in weather modification. Spending in this fiscal year is expected to be about $14 million (up $5 million over FY 1967) for programs in fog dissipation, inadvertent modification (e.g., pollutants and climatic changes), and the modification of precipitation, hurricanes, and severe storms. "All these growing efforts toward the alteration of. . .the atmosphere have been accompanied with a clear realization that. . .there will be increasing problems concerning their legal, social, economic, and ecological aspects".

43. "Big Things Ahead for Air Pollution Research", Environmental Science and Technology, v. 1, no. 12, December 1967, pp. 972-975.

The research program and modus operandi of the new National Center for Air Pollution Control are described. The R&D contract and research-grant areas receiving major attention are noted, and the funds available and expected are discussed.

44. "Congressional Critics Aim to Cut NASA Budget to $4-Billion Level", Aviation Week & Space Technology, v. 88, no. 7, February 12, 1968, p. 22.

NASA is requesting a $4.4-billion budget for Fiscal Year 1969 as compared to its present $4.6-billion budget, but Congress is expected to pass a final appropriation of $4 billion. The key target for cuts is the Apollo Applications Program, which some congressmen believe is a duplication of the Air Force's Manned Orbiting Laboratory. In testimony, NASA Administrator Webb said that industry work for NASA 'is down by 135,000 employees and is still dropping at a rate of about 4,000 per month' and that the proportion of outside contracting would be reduced from 94 to 88 percent to allow more in-house R&D.

45. Wenk, E., Jr., "Towards a Strategy for the Oceans", Address before the Symposium on Marine Resources Development in the Western Region, University of Southern California, Los Angeles, February 2, 1968, 15 pp.

The Executive Secretary of the National Council on Marine Resources and Engineering Development discusses the importance of "the oceans to this nation and to its people", reviews the activities and accomplishments of the Council, comments on the Marine Science budgets (Fiscal Year '69 budget request totals $519 million, up 15 percent over the '68 request), compares U.S. and Soviet efforts in the area, and discusses how much of the Nation's resources should be "devoted to ocean endeavors, and how".

46. Normyle, W. J., "Budget Spurs Apollo Applications Shift", Aviation Week & Space Technology, v. 88, no. 4, January 22, 1968, pp. 25-26.

"Post-Apollo manned space flight program is undergoing significant new changes to accommodate continuing budget restrictions imposed on" NASA. Chiefly affected will be the Apollo Applications Programs which will be stretched out; this program is expected to receive, for the third straight year, less than half of the funds requested.

"The likelihood of additional reductions to be voted by a budget-conscious Congress is high".

47. "NASA's Industry Contract Level Drops", Aviation Week & Space Technology, v. 87, no. 27, Mid-December, 1967, pp. 25-26.

NASA's "concept of placing at least 90% of its annual contracts with private industry is changing. . .in a period of severe budgetary restrictions". "Procurement agreements in Fiscal 1967 with industry fell 8% below that of the previous year, and they are expected to continue to decline". "NASA is seeking measures by which its own research and development field centers can assume roles usually held by industry or universities".

48. Watkins, H. D., "SST Funding Faces Hurdles in Congress", Aviation Week & Space Technology, v. 88, no. 6, February 5, 1968, pp. 30-31.

The $223 million requested for the supersonic transport development in Fiscal Year 1969 is considered to be adequate for "an orderly program pace". The 1969 request would bring the total government spending authorization for the SST to $876 million. Although the $223 million requested is "about $200 million less than what once had been programed for Fiscal 1969", the SST money "still seems certain to be a favorite target for congressional budget cutters".

X SCIENCE, EDUCATION, AND THE UNIVERSITY

34. Greenberg, D. S., "Federal Labs: White House Study Urges Closer University Ties", Science, v. 159, no. 3813, January 26, 1968, pp. 412-414.

The Federal Council for Science and Technology (FCST) will soon issue a set of recommendations for promoting "closer relations between academic institutions and laboratories owned and operated by federal agencies". The recommendations will call for strengthening such existing practices as joint and visiting appointments, joint research and training programs, special university courses for federal employees, and access to federal equipment by university researchers. In addition, federal organizations will be enjoined to take the initiative in setting up such cooperative efforts; greater authority and more funds will be recommended for the laboratory directors to engage in training programs, and increased use of the Government Employees' Training Act is suggested.

35. "The Draft: Empty Seats in Grad Schools?", Scientific Research, v. 3, no. 1, January 8, 1968, pp. 21-22.

Draft deferments will end in June 1968 for all students completing their undergraduate work, finishing their first graduate year, or receiving advanced degrees. Only those students in health-related fields are exempt. Of the estimated 676,000 graduate students, 226,000 are expected to be drafted in 1968-69. This article reviews the background of the new law, samples opinion as to its possible consequences, and discusses the problems with selective deferments and prospects for a random selection plan.

36. "Budget Blow to Be Eased for Academia?", Scientific Research, v. 3, no. 1, January 8, 1968, pp. 9-10.

The one broad exception to the general pattern of R&D cutbacks expected in 1969 is support for research at universities. "The indication is that the '69 budget for academic research will show a significant increase over '68, bringing it back on the line projected from fiscal '66". "What I regard as by far the highest-priority problem, the training of the next generation of scientists, is one that we will protect at all costs", declares Donald Hornig, the President's science advisor.

However, the universities should expect less federal money for travel, equipment, construction, and for post-doctoral support in both '68 and '69. According to Hornig, there will be about a five-percent increase in funds for the life sciences, but in "the physical sciences, I think the picture is a bit more gloomy for right now. There the problem largely derives from the drastic cuts by Congress in the NASA and DOD budgets".

37. "Secret-Research Friction Mounts", Scientific Research, v. 2, no. 12, December 1967, pp. 17-18.

Protests against classified research on campus are spreading: Cornell's faculty senate has voted to sever ties with its Aeronautical Laboratory; Princeton's faculty and students have protested its association with the Institute for Defense Analysis (IDA); Michigan's relationships with IDA have also been challenged as has the University's Willow Run Laboratory's contract for training the "Royal Thai Air Force in infrared weapons for counterinsurgency"; and the University of Minnesota is preparing a new policy which may eliminate all classified research there.

38. "The Universities: Should They Do Classified Research for the Pentagon?", Scientific Research, v. 2, no. 12, December 1967, pp. 32-34, and 36.

This article presents DOD's new policy statement regarding support of classified research at universities and a counter-statement that argues against any DOD funded university research. The DOD statement, issued by John Foster, Jr. (Director, Defense Research and Engineering), announces that "in the future all basic research supported by DOD at universities will be unclassified". However, some applied R&D contracts and consulting arrangements funded by DOD at universities will "remain subject to classification". The "opposition" statement by Ludvig Browman (president of the University of Montana chapter of the American Association of University Professors) proposes that "DOD should fund no university research, secret or otherwise": "This new policy of DOD still doesn't meet the problem because the moment a university permits itself to become dependent on DOD finances, the military has the right to declare secret any project it wishes. Military-related research should be on a consultant basis, and not through the university administration".

39. "Compensate Academia in '69 for Cuts in '68?", Scientific Research, v. 3, no. 2, January 22, 1968, p. 23.

The Administration is considering ways to compensate university researchers in fiscal 1969 for the severe fund cuts in 1968. "One of the schemes being studied . . .is to offer researchers 10- or 11-month grants or contracts using '68 funds with the expectation that the work will be continued with a 14- or 13-month grant of '69 money". Of special concern is the effects of fund cuts on graduate and post-doctoral students: "Research projects can be deferred. . .but student losses are a long-term loss to the nation's resources".

XI SCIENCE MANAGEMENT AND POLICY-MAKING BODIES

37. "Proposed Congressional Center for the Study of Domestic and International Policy", U.S. Congressional Record--House of Representatives, Ninetieth Congress, Second Session, v. 114, no. 8, January 24, 1968, pp. H339-H340.

> Congressman Reid (New York) describes and discusses his bill to create a Congressional Center for the study of domestic and international policy questions. The proposed Center would provide Congress with advice and recommendations on public policy issues and with "the capacity to initiate policy rather than merely to evaluate and implement that proposed by the executive". The Center would be staffed by scholars who would "explore in depth the hard questions which face our nation" and seek an understanding of the "social, moral, and philosophical implications of the scientific and technological advances our society has achieved". The Director of the Center would be solely responsible to a Board of Trustees composed of congressional members and representatives of private industry and the academic and scientific communities. A $100 million endowment would start the Center.

38. Cote, A. J., Jr., "Funding Based on Social Value?", Industrial Research, v. 10, no. 1, January 1968, p. 17.

> William D. Carey of the Bureau of the Budget foresees the possible emergence of "social value" as the criteria for federal support of civilian R&D. He suggests that such criteria might be represented in a "Social Merit Matrix" that compares and weighs competing research programs in respect to their contribution to economic, cultural, and political goals. An illustrative matrix that includes the different types of social values, and the numerical weights assigned to each, is presented for six different research program areas (e.g., desalination, population control, weather modification).

39. "Planning-Programming-Budgeting" - Official documents, U.S. Senate, Committee on Government Operations, Subcommittee on National Security and International Operations, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., July 1967, 34 pp.

> A collection of official documents on the Planning-Programming-Budgeting System (PPBS), including presidential directives and statements initiating the PPBS

throughout the executive branch, and implementation guidelines prepared by the Budget Bureau.

40. "Planning-Programming-Budgeting" - Selected comment, U.S. Senate, Committee on Government Operations, Subcommittee on National Security and International Operations, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., July 1967, 72 pp.

A collection of papers, reports, and statements on program budgeting, systems analysis, and cost-effectiveness studies pertinent to the Planning-Programming-Budgeting System. Includes:

Enthoven, Alain C. - "The Systems Analysis Approach"
Hitch, Charles J. - "Decision-Making in Large Organizations"
Knorr, Klaus - "On the Cost-Effectiveness Approach to Military Research and Development"
Mosher, Frederick C. - "PPBS: Two Questions"
Novick, David - "Origin and History of Program Budgeting"
Rickover, Vice Admiral H. G. - "Cost-Effectiveness Studies"
Rowen, Henry S. - "Bargaining and Analysis in Government"
Wildavsky, Aaron - "The Political Economy of Efficiency: Cost-Benefit Analysis, Systems Analysis, and Program Budgeting"

41. "Planning-Programming-Budgeting", Hearings before the Subcommittee on National Security and International Operations, of the Committee on Government Operations, Part 2, U.S. Senate, Ninetieth Congress, First Session, September 27 and October 18, 1967, U.S. Government Printing Office, Washington, D. C., 160 pp.

Statement of Alain C. Enthoven, Assistant Secretary of Defense (Systems Analysis) on planning, programming and budgeting in the Department of Defense. Includes a discussion of why PPBS is needed; what PPBS is and is not; what systems analysis is and is not; "cost-effectiveness" analysis; the role of systems analysis and PPBS in the cancellation of "Skybolt" and in the TFX decision; centralization of decision making in the Defense Department; achievements of PPBS; PPBS and Vietnam.

42. "Planning-Programming-Budgeting", Hearings before the Subcommittee on National Security and International Operations, of the Committee on Government Operations, Part 1, U.S. Senate, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., August 23, 1967, 63 pp.

Statement of Charles L. Schultze, Director, Bureau of the Budget on planning-programming-budgeting: includes

a description of the PPB system, its multi-year programs approach, and the role of mathematics and computers in the decision process; prospects and problems for PPB; PPB in national security and foreign affairs; the scope of information provided by PPB; risks in the PPB process; responsibility of the Budget Bureau for PPB.

43. "Support for Stronger NSF Role", Industrial Research, v. 10, no. 1, January 1968, p. 16.

This brief article describes the provisions of two pending bills for reorganizing NSF. The House bill aims at converting a "passive organization" into one that would actively guide science along "channels appropriate to the national interests". This bill would strengthen the role of the National Science Board in setting NSF policy. Under the Senate bill, the Board would be advisory and the NSF director would be recognized, in essence, as an administration official with power to set policy. Both NSF and the Office of Science & Technology are reported to favor the Senate bill.

44. "Shannon to Tighten Control Over Grants", Scientific Research, v. 3, no. 1, January 8, 1968, p. 19.

The National Institutes of Health (NIH) are planning to create a unit to "coordinate grant practices and policies and to make sure the various institutes act uniformly . . .with grantees". Other possible changes to be made at NIH in the near future include: a new division or institute for biomedical engineering; "creation of a major manpower organization if NIH" is allowed "to absorb the Health Service's Bureau of Health Manpower"; and a reorganization of the Division of Regional Medical Programs. "However, none of these changes is expected before the entire HEW health structure is reorganized".

45. "Fountain Move Delays Reorganization at HEW", Scientific Research, v. 3, no. 1, January 8, 1968, p. 19.

Plans to reorganize the health structure of HEW have been temporarily set back. Congressman L. H. Fountain, "who had earlier issued a stinging critique of the National Institutes of Health", blocked Secretary Gardner's proposal to create an undersecretary for health with jurisdiction over a reorganized health apparatus at HEW. One possible plan calls for the separation of NIH from the Public Health Service with both reporting to the proposed undersecretary.

46. "Medicine Board is First Step Toward an Academy", Scientific Research, v. 3, no. 1, January 8, 1968, p. 19.

"The recent establishment of a Board of Medicine at the National Academy of Sciences was a halfway step toward creation of an autonomous National Academy of Medicine". "Conversion of the board to an Academy, however, is expected in the early 1970's". "Meanwhile, the board is expected to assume within the Academy of Sciences a status similar to the Committee of Science and Public Policy, as it tackles such questions as: How does one go about bringing the system of medicine in tune with the needs of society?"

47. "The Research Philosophy of James A. Shannon, M.D.", Scientific Research, v. 3, no. 1, January 8, 1968, pp. 44, 46, 48, and 50.

The Director of the National Institutes of Health discusses the research philosophy and policy that has guided NIH over the last 15 years. In the early '50s "our research program was specifically targeted"; this emphasis shifted in the mid '50s to "undifferentiated research" aimed at providing "a very broad base determined by the scientific consensus about what is important", and to training programs for developing scientists rather than medical specialists, with some specific "target research". In addition, "organized research" was launched into areas where "there were not adequate scientists in the field" and where existing organizations were not apt to develop them (e.g., environmental health, biomedical engineering).

48. "Federal Council Enlarged", Science, v. 158, no. 3807, December 15, 1967, p. 1433.

The Federal Council for Science and Technology was recently enlarged by executive order to include members from the Departments of State, Housing and Urban Development, and Transportation. "The council, which the additions bring to 12 members, was established. . .in 1959 to consider the problems and developments concerning the overall advancement of science and technology in the U.S.".

49. "Planning-Programming-Budgeting" - Initial Memorandum, U.S. Senate, Committee on Government Operations, Subcommittee on National Security and International Operations, Ninetieth Congress, First Session, U.S. Government Printing Office, Washington, D. C., August 1967, 8 pp.

This subcommittee-staff memorandum was prepared as background for congressional inquiry into the Planning-Programming-Budgeting System (PPBS). It includes a

brief description of what PPBS is, some of the claims made for its effectiveness, a discussion of the uses, abuses, failures, limitations, etc., of PPBS in the Defense Department, the relevance of PPBS to the State Department and related agencies, and some of the possible implications, both desired and undesired, of PPBS for the President and Congress in respect to their traditional decision-making prerogatives.

50. Enthoven, A. C., "Systems Analysis--Ground Rules for Constructive Debate", Air Force and Space Digest, v. 51, no. 1, January 1968, pp. 33-40.

The author, who is the Assistant Secretary of Defense (System Analysis), describes systems analysis and cost-effectiveness analysis as used in DOD. The paper, extracted from the author's prepared statement to a Senate subcommittee, cites several properties of systems analysis: it defines issues and alternatives, integrates relevant facts, explicitly presents objectives, assumptions, etc., and isolates areas where judgment must be applied. "Cost-effectiveness" is described as a procedure for identifying the alternative that yields the greatest effectiveness from the available resources and is defended against the criticisms that it leads to an overemphasis on cost, stifles innovation, and ignores factors that cannot be reduced to numbers. The author concludes that the overall approach does not automatically produce good decisions, but that it has proved to be a useful tool for helping the decision-maker.

51. Daddario, E. Q., "Technology Assessment", Technology Review, v. 70, no. 2, December 1967, pp. 15-19.

Congressman Daddario discusses the growing need for technology assessment, the responsibility of Congress in this area, and the opportunities and pitfalls that it offers. "Technology assessment" is defined as "a systematic analysis of the alternatives available in using scientific and engineering knowledge in the service of mankind" with the "benefits and risks of each policy alternative carefully described". Daddario believes that Congress has the prime role in assessment and foresees the possibility of a "special organization performing technology assessment for the legislative branch". He reviews his bills to establish an assessment board, notes that assessment is presently haphazard because "we have never fixed the responsibility for the total results of technology", and warns that assessment "could easily become a stifling influence on progress if it emphasizes the dangers rather than the potentials for good".

52. Greenberg, D. S., "The Congress and Science", Technology Review, v. 70, no. 3, January 1968, pp. 6-7.

Congress' shortcomings in dealing with science and technology are cited and illustrated, their causes and consequences are diagnosed, and cures are prescribed. "Congress' inadequacy, both in personnel and organization, for dealing with science and technology has become a minor horror--though one with a great growth potential". Recent efforts to improve the situation are of only potential significance, because the "essential power over the development and employment of science and technology still remains. . .in an ancient and balkanized committee structure. . .indifferent to any view of the interdependence of science, technology, education, and economic development". The prescriptions offered include: more scientists and engineers on congressional staffs; a more comprehensive view of science and technology across the various agencies; and "an annual presidential report on the state of the nation's science and technology".

53. "A New Force Emerging For Science in Senate", Scientific Research, v. 2, no. 12, December 1967, p. 31.

Sen. Edward Kennedy "has taken up the cudgels for science". He teamed with Sen. Fred Harris "to drive through a $67-million increase for the National Science Foundation after the Senate. . .had recommended a deep cut; then he got approval to set up--and chair--an ad hoc Senate committee to review Rep. Emilio Q. Daddario's NSF reorganization bill". Sen. Kennedy may become further involved with science matters in the future: there is some possibility that he will become chairman of the Senate Health Subcommittee if its present chairman, Sen. Lister Hill, fails to run for office in 1968.

54. Drew, E. B., "The Health Syndicate/Washington's Noble Conspirators", The Atlantic Monthly, v. 220, no. 6, December 1967, pp. 75-82.

This article describes the Washington "health lobby"--its composition, modus operandi, internal conflicts, and its extraordinary influence over medical research--and discusses the "distortions" it has produced in federal health policies. The growth of the National Institutes of Health (NIH) is traced and the crucial roles played by the "health syndicate" (viz., Mary Lasker, James Shannon, Rep. John Fogarty, and Sen. Lister Hill) in promoting NIH's policies and programs are critically described. Federal health policies are criticized for giving priority to diseases of the aged while the U.S. "has an infant mortality rate that is worse than that in

fourteen other countries", while 40 percent of the young male adults are unfit for military service, and while many of "the handicapping conditions which children now suffer. . .could be prevented". The author disputes the claims made by the "Lasker group about how our investment in health research has produced longevity" and calls for a broadened concept of "health" and a reduction of the "inequities in medical services".

55. Price, W. J., "Formulation of Research Policies in a Mission-Oriented Agency", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 189-196.

The research policies followed by the Air Force Office of Scientific Research (AFOSR) are briefly described and discussed. The role of AFOSR is to support "phenomena-oriented research" and to provide two-way communication "between the scientific community and the using agencies" of the Air Force.

56. Brooks, H., "Basic Science and Agency Mission", paper in Research in the Service of National Purpose, F. J. Weyl (Ed.), Department of the Navy, Office of Naval Research, U.S. Government Printing Office, Washington, D. C., 1966, pp. 33-47.

For the first time since WWII, "the assumptions on which our science policy. . .have been based are being seriously questioned and even challenged". A defense is made for one facet of the present science policy: the support of basic research by mission-oriented agencies. "The whole argument is about what basic research really is relevant to a mission, and what time horizon one should be talking about". The author discusses the reasons for supporting basic research, defines the categories of research that agencies should support and the form the support should take, warns that projects like "Hindsight" "are very likely to lose the trail just at the most interesting point", and cites several examples of basic research sponsored by the Office of Naval Research that led to significant, practical pay-offs.

57. Rosenstock, H. B., "Who Should Support Scholarly Research?", Bulletin of the Atomic Scientists, v. 24, no. 1, January 1968, pp. 60-62.

A case is made for mission-oriented agencies to conduct "scholarly research in-house rather than on contract with universities" and for the National Science Foundation "to take over. . .much of the research at universities now sponsored" by these agencies. The need for

scholarly (basic) research by mission agencies is discussed and three major ways in which it could be obtained are analyzed for their cost-effectiveness with the conclusion that "scholarly research done at in-house institutions" best meets the needs of these agencies. The amount of scholarly in-house research needed is "appreciably larger than the amount that is done. . .today, but much smaller than the amount sponsored by mission-oriented agencies at universities".

58. Dror, Y., "Policy Analysts: A New Professional Role in Government Service", Public Administration Review, v. 27, no. 3, September 1967, pp. 197-203.

"Systems analysis can be of only limited utility in government unless it changes so as to be better able to deal with qualitative and political phenomena". Instead, "policy analysis should be developed"; it would combine "methods of system analysis with qualitative methods and. . .awareness of. . .political phenomena" and operate as a "new component which contributes to aggregate policy-making without preempting. . .the functions of politicians and line executives". "Immediate steps can and should be made. . .in the direction of policy analysis within the efforts to introduce a Planning-Programming-Budgeting System in federal administration".

59. Miller, A. R., "The National Data Center and Personal Privacy", The Atlantic Monthly, v. 220, no. 5, November 1967, pp. 53-57.

The threats posed to individual freedom and privacy by the proposed National Data Bank are cited and discussed and necessary legislative, procedural, and technical safeguards are proposed. The latter include: methods "to guarantee the accuracy and integrity of the stored information, and those needed to control its dissemination"; legislation, with civil remedies and penal sanctions, to establish the appropriate balance between the information needs of the government and the right of individual privacy; and a completely independent agency "to formulate policy under whatever legislative guidelines are enacted".

60. "A New Patent Law is Pending", Business Week, no. 2005, February 3, 1968, pp. 74-76.

The Commerce Department's willingness to compromise on the proposed patent-reform bill may lead to a new patent law before the 90th Congress adjourns. Reform of the present law "is needed. . .to raise the quality

and reliability of U.S. patents. . .to reduce the time and expense of protecting them. . .to speed public disclosure of scientific and technical information". The main compromises the Department is now ready to make are: its "insistence on the first-to-file system. . . as a replacement for the. . .first-to-invent rule"; a "more flexible approach to redefining what is covered by prior patents"; and less "insistence on prompt patent disclosure".

VII SCIENCE, FOREIGN AFFAIRS, AND NATIONAL DEFENSE

46. Mondale, W. F., "The Cost of the Brain Drain", The Atlantic Monthly, v. 220, no. 6, December 1967, pp. 67-69.

> "Permanent migration of engineers, scientists, and medical personnel from developing countries to the U.S. has grown 250 percent in ten years, compared with a 25 percent increase in the flow from advanced nations." Senator Mondale illustrates and describes the cost of this brain drain to the developing countries, criticizes the recent Frankel Report for understating the seriousness of the drain, and suggests some needed changes in U.S. policy. Instead of the present policy (which is "consciously shaped. . .for our manpower needs"), Mondale proposes (1) negotiated bilateral agreements to prohibit the immigration of technical personnel needed in the developing countries, (2) a system for selecting foreign students that takes into account the manpower needs of the particular country, and (3) measures to encourage and prepare the student for returning to his country.

47. Inglis, D. R., and Sandler, C. L., "Prospects and Problems: The Nonmilitary Uses of Nuclear Explosives", A Special Report on Plowshare, Bulletin of the Atomic Scientists, v. 23, no. 10, December 1967, pp. 46-53.

> Project Plowshare is aimed at three categories of proposed peaceful applications of nuclear explosives in the earth: (1) excavation and earthmoving, (2) unearthing natural resources, and (3) experiments in pure science. While Plowshare appears to offer some short-term economic advantages in specialized areas, there is no application which is sufficiently important to warrant its continuation should it prove to be the only obstacle to a total test ban on nuclear weapons. There is the possibility that other nations might be sufficiently attracted by economic benefits to permit Plowshare to stand as the lone exception to an otherwise total test ban.

48. "IDA and the Universities: What Next?", Scientific Research, v. 3, no. 1, January 8, 1968, pp. 23-27.

> The Institute for Defense Analysis (IDA) is studied against the backdrop of growing university concern over involvement with the Institute. Protests against the association have recently occurred at six of the 12 universities that sponsor IDA. The Institute's

management, however, stresses the mutual benefits from the association: faculty members can contribute to national defense through classified research without directly involving the university, while university sponsorship preserves IDA's research objectivity and independence. IDA's role in the national-security-research network is described and some examples of its work for DOD are cited. Congressional skepticism of IDA's value and criticism of its salary structure are countered by DOD officials. To lessen its dependence on DOD, IDA is seeking work in other fields and is now organized to give more attention to civil problems.

49. Diebold, J., "Is the Gap Technological?", Foreign Affairs, v. 46, no. 2, January 1968, pp. 276-291.

The nature and causes of the "technology gap" between the U.S. and Europe are discussed and steps are prescribed for closing it. The author concludes that although the U.S. is ahead in certain areas, the gap is "caused by a number of European managerial and financial inadequacies, as well as by a still outmoded educational system, social immobilities, and political barriers". Examples of European technological innovations that were not followed up because of these liabilities are presented. Steps that Europe can take to close the gap include: national and supranational goals and priorities; compatible laws that will allow business mergers and marketing across countries; improvements of the education system; and the hiring of U.S. talent. Cooperative steps for the U.S. include: incentives for U.S. corporations to establish R&D facilities in Europe; contributions to European education reform; revision of export laws to allow the U.S. to become a more reliable supplier of technology; and encouragement of European participation in U.S. ventures.

50. Greenberg, D. S., "Social Science: Federal Agencies Agree to End Covert Support", Science, v. 159, no. 3810, January 5, 1968, pp. 64-66.

New ground rules for government-supported, social-science research in foreign countries have just been issued by the Foreign Area Research Coordination Group. The rules, which apply only to university research supported by the government, aim at preventing "any deception as to which agency is supporting a project and for what purpose", and at dispelling foreign mistrust created by Project Camelot and by the CIA's involvement in such research. The 21 agencies covered by the guidelines, "while not swearing off classified foreign area research in universities, have agreed to deemphasize it in favor of. . .

nonacademic institutions". The guidelines are criticized for their ambiguity, contradiction, incompleteness, and probable ineffectiveness.

51. Kash, D. E., The Politics of Space Cooperation, Purdue University Studies, Purdue University, Lafayette, Indiana, 1967, 137 pp.

This study describes the U.S.'s participation in international space programs and discusses the implications for foreign policy. It concludes that the cooperative programs were generally designed to achieve "conservative" goals (to strengthen the U.S. vis-a-vis the USSR) or in some cases, "instrumental" goals (e.g., to advance knowledge), but not innovative ones (to create a new political reality and to reduce world tension), even though the latter goals were offered as the major justification for starting the programs. The failure to pursue innovative goals is attributed to a number of factors including the placement of the programs under NASA whose prime mission is "to beat the Soviets into space". In addition, the "tyranny of realism"--the prevailing perception of the international political reality--was so dominant that "the effort to design a program. . .which might create a new political reality was doubtless never considered".

52. Dedijer, S., "The Future of Research Policies", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 141-162.

This "research on research" study is an analysis of the forces that determine the forms and frequency of international research relations. Four interacting factors are reported to be involved: geographical location, political system and foreign policy, degree of development, and size of the country. The author concludes that the communication of national research policies among nations is itself a major new form of international research relation that is leading to: common terminology, a common set of input-output research indicators, and the identification of common decision problems regarding investments in research. In addition, the increasing interdependence and coordination of national policies may eventually lead to "a world research policy".

53. Beaton, L., "Nuclear Proliferation", Science Journal, v. 3, no. 12, December 1967, pp. 35-40.

"While diplomats ceaselessly strive to halt the spread of nuclear weapons, the wherewithal to make plutonium

bombs is falling into the hands of one country after another as a byproduct of commercial nuclear power stations". The development of this situation and its implications are discussed.

54. Baker, W. O., "Science and National Security", paper in Research in the Service of National Purpose, F. J. Weyl (Ed.), Department of the Navy, Office of Naval Research, U.S. Government Printing Office, Washington, D. C., 1966, pp. 92-121.

The role of contemporary science in defense systems is described and illustrated. The areas of defense to which recent basic science has contributed are enumerated and the new role of scientists in systems engineering and systems development is discussed. In addition, the author presents several detailed examples of the application of "extra-missionary, new science" to missile systems, satellites, nuclear weapons, energy sources, etc.

55. Lutz, C., "The 'Technological Gap': Analysis of a European Nightmare", Swiss Review of World Affairs, v. XVII, no. 11, February 1968, pp. 9-11.

The meaning and significance of the "technology gap" between the U.S. and Europe is analyzed, and the possible lessons it holds for Europe are discussed. Conclusions include: those "obsessed with the gap" have failed to prove its "technological nature" or that there exists any connection between R&D expenditure and economic growth; American research policy, coupled with monopolistic competition, produces a "parallelism between size of enterprise, export intensity, and research and development activities"; the "managerial gap" cited by Secretary of Defense McNamara reflects "the puritan work ethics of the American settlers"; European industries, other than the advanced technology types, are equal or superior to those of the U.S. As to lessons, the paper calls for an "international division of labor in technology" with "concentration on one's own strength, removal of obstacles to the size of enterprises so that they can match new market dimensions, and greater "dynamism and. . .rationality for translating knowledge into returns."

56. Brown, H., "The Political-Economic Web: Crisis in Development", Bulletin of the Atomic Scientists, v. 23, no. 10, December 1967, pp. 2-7.

This paper, presented at the 17th Pugwash Conference, reviews and discusses the "depressing developments" in

international relations, population and economic-development problems of poor countries, criteria for capital and technical assistance, and an international program for attacking several political-economic problems. Conclusions include: the "problem of eliminating hunger. . .is. . .the problem of economic development"; the poor countries cannot improve their condition without expanded help over the next 50-100 years; the greatest immediate need is for technical assistance; it may be easier to solve several of the interlocking web of problems "simultaneously as an interrelated group" rather than separately; and scientists should take the lead in starting and directing the suggested international programs.

57. Carter, L. J., "New AAAS Committee to Study Chemical Defoliants", Science, v. 159, no. 3812, January 12, 1968, p. 179.

"The new AAAS Committee on Environmental Alteration . . .will consider as its first order of business the ecological impact of chemical agents used in Vietnam and elsewhere". The new group will evaluate the Midwest Research Institute's report on the effects of defoliants and herbicides used in Vietnam and the review of the same study to be made by the National Academy of Sciences--National Research Council.

58. Boffey, P. M., "The Brain Drain: New Law Will Stem Talent Flow from Europe", Science, v. 159, no. 3813, January 19, 1968, pp. 282-284.

An "immigration law that becomes fully effective 1 July will plug the 'brain drain'" from among European countries "for about 3 years and will open the way for a drain of talent from the Far East and the underdeveloped world". The background and implications of the law are discussed.

59. Boffey, P. J., "Defense Issues Summary of Defoliation Study", Science, v. 159, no. 3812, February 9, 1968, p. 613.

"The Department of Defense has released a 'summary digest' of a report designed to assess the ecological impact of herbicides used for defoliation and crop destruction in Vietnam". The digest summarizes a "state-of-knowledge" survey prepared by the Midwest Research Institute. The general conclusion is that herbicides used up to this time have not produced an ecological disturbance.

XIII SCIENCE POLICY IN FOREIGN COUNTRIES

60. "Science Policy and Organization of Research in the U.S.S.R.", Science policy studies and documents, UNESCO, no. 7, 1967, 116 pp.

This report, prepared by the State Committee of the Council of Ministers of the USSR for Science and Technology, focuses on the organizational structure of science in the USSR and the influence of the socialist philosophy in shaping that structure. The report presents a historical survey of science policy in the USSR, the general aims and methods of formulating science policy, the organization and management of science and technology including the structure of various bodies and their interrelations, the financing of research and education including data on expenditure patterns, and a discussion of the economic, political, and social factors influencing science policy. The document includes 30 pages of statistical data and a short bibliography.

61. "Common Market Technology", Industrial Research, v. 10, no. 2, February 5, 1968, p. 18.

Britain has proposed a European Institute of Technology to be established in London. The institute would be sponsored by European governments, and controlled by an international board representing industry and government. The success of the proposal "will depend largely upon the attitude of the European Economic Community (EEC) countries". A Common Market committee recently recommended an expansion of joint technological R&D activity, and the proposed institute is being considered as one means of implementing this recommendation. "At the moment, the outlook for any cooperative effort is discouraging".

62. "Co-Op Research Study", Industrial Research, v. 10, no. 2, February 5, 1968, p. 18.

An OECD report, "Industrial Research Associations in the United Kingdom", discusses the problems confronting the 50 associations that undertake cooperative research on behalf of British companies. A major problem centers around "how to organize sponsored research--undertaken on a confidential basis for one client--with a general program of cooperative research for the membership". Other problems include the expansion of independent British groups into the contract R&D area, and the

increasing activity of American organizations in the British contract field.

63. "Industrial R&D Network", Industrial Research, v. 10, no. 2, February 5, 1968, pp. 16-17.

A network of R&D centers to assist British industry has been set up under a $2.4 million program. The seven centers of the network are intended to provide R&D services to small and medium-sized firms that are unable to finance R&D on their own. The program is supported by a grant for two years, by the end of which the centers are expected to be self-supporting.

64. "Low R&D Support Hurts Japan", Industrial Research, v. 10, no. 2, February 5, 1968, p. 16.

"The level of Japanese R&D spending is relatively low--about 1.7 percent of the gross national product--when compared to other large industrial countries, where the percentage is double or triple that figure", according to a recent OECD appraisal of Japan's science policy. Two reasons are given for this condition: the Japanese government funds only about 30 percent of the nation's R&D investment as compared to more than 60 percent in other advanced nations; Japanese industry borrows technology from others on a licensing basis rather than support R&D. The report emphasizes that "Japan will need to develop technological advantages to maintain her competitive position in international trade".

65. "Mexican Talent Drain", Industrial Research, v. 10, no. 2, February 5, 1968, p. 18.

The "brain drain" from Mexico has reached "embarrassing" proportions in the last few years. To counter this drain, the Mexican government is setting up an organization "to promote the fullest development of science and technology and to seek the creation and strengthening of research centers. . .to avoid further flight of skilled talent". The new organization and associated research centers will look to industry for funding and will seek cooperative arrangements with counterparts in other countries.

66. "Devaluation Brings R&D Cutback", Industrial Research, v. 10, no. 1, January 1968, p. 20.

The devaluation of the pound sterling has resulted in a cutback of funds for British scientific-research and

defense programs. Some major research projects have already been postponed, including the "building of a national magnet laboratory, a nuclear reactor for materials research, and equipment for particle research". Defense R&D, "currently at a level of $700 million, probably will feel the brunt of the cutbacks".

67. "Nuclear Consortium", Industrial Research, v. 10, no. 1, January 1968, p. 20.

"A single British nuclear-power group is suggested as a remedy for Britain's failure to hold its own against United States competition in the world market for nuclear equipment". The proposed consortium, consisting of the U.K. Atomic Energy Authority, electrical equipment companies, "and possibly a uranium producer", would develop new reactors, supply nuclear fuel, and design and engineer nuclear-power stations.

68. "Telescope Threatened", Industrial Research, v. 10, no. 1, January 1968, p. 22.

"Europe's most advanced space research program--to build a satellite telescope laboratory--may be postponed because of high costs". A report prepared for the European Space Research Organization sets the expected cost of the total program, which has waited for six years for approval, at $112-million.

69. Ellis, R. H., Jr., "Britons Seek Closer Relations Between Industry and University", Physics Today, v. 21, no. 1, January 1968, pp. 54-58.

"British tradition is rooted deep in the soil of solid accomplishment. Its science, though, is not providing the sustenance that the nation needs. . ." "Not enough trained physicists move from college to plant". Ellis reports on his observations and interviews with academic and industrial leaders about the problem. There is general agreement that something should be done, but somewhat less general agreement about what that something should be. Among the suggested remedies are more consulting arrangements with university staffs, an increased appreciation by industry of the value of scientific Ph.D. training, joint university and industry support and supervision for Ph.D. research by university students, and sabbatical and exchange programs for both university and industrial scientists. Committees have studied the problem and meetings have been held, but so far with indifferent success.

70. "New Advisors for Germany's Research", Scientific Research, v. 2, no. 12, December 1967, p. 23.

"In a move to strengthen the government's already growing role as a supporter of science, West Germany's Science Ministry has established a high-level, science-advisory committee". The function of the 14-member committee will be to coordinate the research appropriations of the German government.

71. Weiss, C., Jr., "Africa: A Science Odyssey", Scientific Research, v. 2, no. 12, December 1967, pp. 64-68.

This report describes the infrastructure and organization of science in Africa, the research facilities and their use, scientific and supporting manpower, the state of science education, and the achievements, needs, problems, and prospects of basic and applied research. Observations and conclusions include: a major need is for scientists with "traditional training who will lay down an infrastructure on which future work will be based"; efforts to foster international "centers of excellence" are giving way to national institutes; the greatest challenge in scientific education is at the primary level; most scientists are still "expatriates" on extended leave from British and French universities; the U.S. could help by supplying experienced personnel for research teaching and administrative tasks, as well as graduate students to serve as demonstrators, undergraduate tutors, and directors of undergraduate research.

72. Walsh, J., "Euratom: A Cut for Cooperation", Science, v. 158, no. 3809, December 29, 1967, p. 1657.

Euratom's budget for 1968 will be $40.7 million instead of the $82 million requested. The cut was achieved by suspending all Euratom-supported R&D in the six member countries. The new budget will permit "Euratom's own four research centers to remain open and its personnel to be kept largely intact", but its programs in nuclear fusion and biology could be terminated unless the individual countries take over a large portion of the funding. No long-term plans have been approved for Euratom's future; some "see the association agreements being replaced by programs in which participation is voluntary".

73. Woodward, F. N., "Cooperative Research in Europe", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 119-132.

This report surveys and evaluates the cooperative research programs in Europe. These are of two types: (1) National Cooperative Industrial Research Associations (RA's) that are set up by an industry to undertake research work for it as a whole and which are financed either solely by industry or jointly by industry and government; (2) International programs under OECD in which national laboratories working in the same field cooperate in the solution of common problems.

74. Afifi, A. A., "Organization of Industrial Research in Developing Countries", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 133-139.

This report attempts "to identify the potential role of research and development in supporting industrialization in developing countries", surveys "the machinery for such functions as they exist in a sample of countries", and summarizes "the activities of the United Nations Center for Industrial Development in this field".

75. Henry, L., "Applied Research in Belgium", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 3-12.

The mission, policies, problems, and accomplishments of the Institute for the Encouragement of Scientific Research in Industry and Agriculture are described. This Institute has had a prime role in fostering a highly developed form of cooperative industrial research in Belgium; the policies, mechanisms, and problems of such efforts are described in some detail.

76. Rosser, F. T., "National Research Council of Canada", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 13-21.

The National Research Council "has the specific duty of advising the government on scientific policy. It also has wide powers for undertaking, assisting, and promoting all aspects of scientific research in Canada". This paper reviews the policies and activities of the Council since its inception in 1916.

77. Franck, T., "Scientific and Industrial Research in Denmark", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 23-27.

The general organization of Denmark's scientific- and industrial-research activities and the policies guiding them are described. The Council for Scientific and Industrial Research, which is Denmark's chief policy-making body, provides advice to government, allocates funds to research institutes outside the universities, and ensures that the supported institutes coordinate their activities. Cooperative research under "Nordforsk" (Scandinavian Council for Applied Research) has enabled Denmark to cover a broad spectrum of research with her small number of technical personnel.

78. Piganiol, P., "Science Policies in France", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 29-39.

The paper discusses the nature, objectives, and scope of science policy, and the roles of parliaments and public opinion in their formulation. Further discussion is included on some of the idiosyncrasies of French companies and society that inhibit the application of science and technology and the ways in which the government helps industrial research. Problems and prospects of national and international cooperative research are discussed and the modes of economic organization most suitable for underdeveloped countries are suggested.

79. Goerlich, F. K., "Facts and Trends of German Research Policy", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 41-45.

This paper succinctly describes how science is funded, organized, and managed in the Federal Republic of Germany. Included is information on the amount of funds devoted to R&D (in total and by sectors and areas of research), sources of funds (e.g., about one-third of the R&D is financed by industry), sponsoring arrangements, and coordination mechanisms.

80. Cranley, M. J., "Science in Ireland", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 47-64.

This survey describes the state and semi-state bodies engaged in research, their organization and functions, and the amounts and sources of R&D expenditures. The activities and policies of the various bodies are discussed in relationship to Ireland's economic development.

81. Julius, H. W., "Applied Scientific Research Policy in the Netherlands", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 65-76.

Science policy in the Netherlands--past, present, and future--is described and discussed. At present, two principal organizations set the government's science policy: the Organization for Applied Scientific Research and the Netherlands Organization for the Advancement of Pure Science. As to the future, more planning and policy-making are needed: "sooner or later money will cease to be inexhaustible"; a central advisory committee will probably be created; and "judgment by peers" as a means of assigning priorities must be replaced by "evaluative forecasts" and "analyses of possibilities and incompatibilities".

82. Pannenborg, A. E., "A Case Story of Industrial Research", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 183-188.

The policies for industrial research at the Phillips Research Laboratories (Eindhoven, Netherlands) are described. The organization of the laboratories, their mode of operation, research policy, communication procedures, and personnel policies are all discussed.

83. Colombo, U., "Research Policy in the Montecatini Group", paper in Formulation of Research Policies, L. W. Bass and B. S. Old (Eds.), Publication No. 87 of the American Association for the Advancement of Science, Washington, D. C., 1967, pp. 173-182.

The organization of research in the Montecatini Corporation (Italy's leading chemical and mining enterprise) is described and the mechanisms and procedures for formulating research policy are illustrated. A brief description of the organization of government-supported research in Italy is included, as well as some data on R&D expenditures.

84. Adamson, R., "Mobilizing Soviet Science", Scientific Research, v. 3, no. 2, January 22, 1968, pp. 24-34.

The new and little-publicized State Committee for Science and Technology is "developing a mounting measure of authority over Soviet science". The Committee is responsible "for review of all R&D budgets except those for defense, space and atomic energy", has veto power over creation of any research institute, sets manpower policies, and promotes and coordinates applied research related to economy development. This report, based on a visit to the Soviet Union, describes the structure and operation of the Committee, gives estimates of the Soviet investments in research, and discusses problems and policy issues.

85. Djerassi, C., "A High Priority? Research Centers in Developing Nations", Bulletin of the Atomic Scientists, v. 24, no. 1, January 1968, pp. 22-27.

Basic research centers of recognized excellence are indispensable for developing nations. The benefits from such centers are cited, an illustrative center in Mexico is described, and the problems and possible solutions to setting up such centers are discussed. A model center would be staffed by an international cadre of postdoctorate researchers, directed by a group of part-time directors from major universities in different developed countries, and would conduct research in areas having an ultimate economic pay-off and a maximum multiplication factor.

86. Valéry, N., "A Policy for Ocean Industry", Science Journal, v. 3, no. 12, December 1967, pp. 74-84.

The organization, policies, and programs of British oceanography are described and compared with those of the U.S. The paper looks "at how industry in the United States is being stimulated into ocean research and development" and examines conditions in Europe to see whether they "favor the same kind of approach". Several reforms in the British approach are proposed.